

high area rapidly advancing in its rear which considerably accelerated its motion and, as the equilibrium of pressure was still further impaired by a low area on the southeastern coast, the gradients over the Lakes became close, and heavy local gales again prevailed on the 28th and 29th in that region. Local rains and snows also attended the passage of this depression and further increased the dangers of navigation on the Lakes. The movement of this low area across the country was very rapid, its path, of about 2,700 miles, having been traversed at an average speed of about 48.2 miles per hour.

X.—The low area which had for several days been indicated as in the Gulf of Mexico, beyond the limits of observation of adjacent coast stations, was on the morning of the 29th approximately located off the southwestern coast of Florida, about two hundred miles to the northwest of Key West. Local rains had been frequent in the Rio Grande Valley, Gulf States, and Florida since the 24th. A high area was now advancing southward near the Mississippi. Crossing the Florida Peninsula during the next eight hours the centre of the disturbance trended more to the northward and, moving approximately parallel with the coast and at a comparatively short distance from it, progressed northeastward. The rains in the Gulf ceased after its advance into the Atlantic, but extended northeastward along the coast as the disturbance moved in that direction. It apparently increased in energy during translation and was accompanied by heavy gales, especially on the coasts of North Carolina and Virginia. In the vicinity of Norfolk, Va., the storm seems to have been especially severe on the 31st and to have caused much general damage. At the last report of the month the depression was apparently central off the coasts of Delaware and Maryland. Its energy was perhaps at its maximum when off the Virginia coast on the afternoon of the 31st. The pressure at that time at Norfolk was .56 below the normal, but was probably much less nearer the centre.

Observers in North Carolina and Virginia make the following reports regarding this storm:

Hatteras, N. C.: a storm began 4.05 a. m. and ended 2.20 p. m. on the 31st; a maximum velocity of fifty-four miles per hour from the north was recorded at 4.22 a. m.

Kitty Hawk, N. C.: rainy and brisk northerly winds becoming high, with a maximum velocity of sixty miles per hour, at 10.15 p. m. on the

30th. A severe rain and wind storm prevailed until 2 p. m. on the 31st, and for seven hours, from 4 until 11 a. m., the wind velocities averaged over sixty miles an hour; at 10 a. m. the storm attained its greatest force, the wind then reaching a velocity of seventy miles per hour. Considering the severity of the storm, very little damage was done in this vicinity.

Lenoir, N. C.: light rain prevailed at 8 a. m. on the 30th, it was accompanied by hail for a short time in the afternoon, and a few flakes of snow fell.

Raleigh, N. C.: a heavy rain storm began during the night of the 30-31st and continued until 1.10 p. m., when hail fell for about ten minutes. It again turned to heavy rain and was accompanied by snow from 6.30 to 8.30 p. m., when heavy rain set in anew and ended at 10 p. m., 4.18 inches of rain and melted snow having fallen during the prevalence of the storm.

Chicamiconico, N. C.: a heavy gale from the east, accompanied by a few claps of thunder, prevailed during the early morning of the 31st. The storm prostrated several telegraph poles on Body Island and south of Little Kinna-keet, cutting off telegraphic communication.

Cape Henry, Va.: a violent wind, rain, and sand storm prevailed during the day of the 31st. During the storm four schooners were driven ashore at different points between this place and Dam Rock, Va., and many vessels around the capes are still in danger; two lives are reported to have been lost. The wires between this point and Norfolk are in trouble and communication cut off.

Norfolk, Va.: a northerly gale prevailed throughout the day of the 31st, attaining a maximum velocity of forty miles per hour from the northeast. The gale is said to have been of longer duration and caused more damage than any storm since the memorable August gale in 1879. A number of vessels were blown ashore and became total wrecks. The captain and one man of the schooner "Manantico" were drowned. On account of heavy rains and high tides, much merchandise has been damaged or destroyed by water.

XI.—A slight depression was observed in the western Saskatchewan valley on the afternoon of the 29th. Although the barometer was but little below the normal, yet the pressure had decreased nearly .3 in that vicinity during the previous eight hours, and a high area, about .6 above the normal, then existed west of Lake Superior. This low area advanced south-eastward through the valley, reached the lakes north of Manitoba on the afternoon of the 30th, and thence passed eastward into the British Possessions beyond the field of observation. The high pressure which had meanwhile moved southward probably modified its path and forced it farther to the northward. A low area was observed near the mouth of the Saint Lawrence on the afternoon of the 31st and still remained in that vicinity at the close of the month. This is believed to have been the same depression which was last observed near Lake Winnipeg on the 30th, and which had apparently progressed thus far seaward.

NORTH ATLANTIC STORMS.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

MOVEMENTS OF HIGH BAROMETER AREAS OVER THE NORTH ATLANTIC OCEAN.

In the preparation of the following discussion, by Sergeant E. B. Garriott, Signal Corps, daily charts for 1885, containing data from international simultaneous observations taken at noon, Greenwich mean time, have been carefully studied, with a view of determining the general movement of anti-cyclones over the north Atlantic:

The scientific methods pursued by the Signal Service during the past few years in the study of marine meteorology have resulted in deducing facts relative to the movements of ocean storms, whose practical value can hardly be overestimated. These deductions, while to a considerable degree verifying the results of old observations taken and collected by individuals, have, by their wider scope, and in view of the increased facilities afforded by a systematic series of simultaneous meteorological observations taken by hundreds of shipmasters, permitted a more accurate definition of the general laws which attend atmospheric changes over the north Atlantic Ocean. In connection with the current work of the Signal Office, the cyclonic depressions which appeared over the north Atlantic Ocean have been traced and described, and their general characteristics as regards direction and velocity of movement, frequency, and distribution, have been fairly well determined. This work has been necessarily performed in a very limited time, and is, therefore, lacking in details as to the causes which seemed to contribute to the normal and abnormal movements of cyclones. Further labor and judgment will therefore be needed to extract from the invaluable accumulation of data on file the facts that will lead up to a clearer understanding of the laws governing storm movements on the north Atlantic.

In an article entitled "North Atlantic storms during 1885," which appeared

in the MONTHLY WEATHER REVIEW for July, 1887, the apparent dependence of a cyclone's movement upon its position with reference to anti-cyclonic areas was briefly discussed, and it was shown by a tabulated statement that during periods of high barometric pressure over mid-ocean north of the fortieth parallel, storm-areas do not follow the usual east-northeast course to European waters, but pursue a more northerly track, or disperse.

As areas of high barometric pressure influence to a greater or less degree the movements of low barometer areas, and as the anti-cyclonic and cyclonic areas are chiefly and conjointly instrumental in producing all atmospheric changes, it would seem that investigations tending to produce facts relative to the movements of anti-cyclones over the Atlantic would be of interest when considered in connection with the movements of cyclonic areas, and of value in determining the laws and conditions which govern weather changes in the great highways of the ocean.

The series of international observations show that an accumulation of air exhibiting an anti-cyclonic circulation is commonly located over mid-ocean south of the fortieth parallel, and that a barometric depression usually occupies the ocean north of the fiftieth parallel. The storm-track charts also show that the normal direction of movement of cyclonic areas in any given locality corresponds closely with the prevailing wind-directions in that locality, which are governed over the ocean by the anti-cyclonic and cyclonic systems referred to. It has been found that in their passage from the North American continent areas of high and low barometric pressure follow one another with a great degree of regularity, and that while areas of low pressure have a normal north of east course after leaving the coast, the high pressure areas almost invariably move south of east. The normal direction of movement of cyclonic areas in the trans-Atlantic tracks is evidently due to the prevailing drift of the atmosphere in the vicinity of the fiftieth parallel, along the line of which is the intermediate region between what may be termed the permanent areas of high and low mean barometric pressure, under the combined influence of which the

prevailing winds in that latitude are from about west-southwest. The almost constant presence of these extensive anti-cyclonic and cyclonic areas in the region named is attributed to influences exerted by the more general laws and movements of the atmosphere over the earth's surface, and is also ascribed, in part, to the deflection of the normal air currents by the more elevated portions of the continents. Suffice it to say in treating of the meteorology of the north Atlantic Ocean, that upon advancing from the American coast areas of low barometer appear to move towards the region of barometric minima, and areas of high pressure are apparently attracted to the region of maxima.

During 1885 sixty areas of low pressure advanced eastward over the ocean from the American coast; during the same period fifty-two well-defined areas of high barometer were traced from the interior of the continent and passed off the coast, of which seven traversed the ocean to Europe, and three moved northeast to the vicinity of Iceland; the remaining high areas advanced east or south of east and united with the cyclonic system south of the fortieth parallel. In tracing the anti-cyclonic areas eastward from the Mississippi Valley to the coast, it was shown that between the thirtieth and fortieth parallels the paths ran almost due east, while to the northward of the fortieth parallel they were south of east, the southern inclination increasing with the northern origin of the areas. The great uniformity of movement of the areas of high pressure, about 90 per cent. of which pursued a south of east course from the American coast, seems to indicate that their direction of movement can be calculated with a greater degree of certainty than the probable track of low pressure areas. It would also appear from a study of the simultaneous movements of high and low barometer areas over the ocean that the areas of high pressure move with greater rapidity than low areas, and that the direction of their course and the velocity of their movement is seldom influenced by the cyclonic areas which may precede or follow them. On the other hand it has been observed that the movements of cyclonic areas are largely influenced by anti-cyclonic areas, which apparently cause barometric depressions to deviate from their course, and in many instances to dissipate, when situated in their line of advance. Without considering the anti-cyclonic areas of an apparent local character which appeared during the year over the land and ocean, but confining the discussion to the more important and well-defined high areas which traversed the continent east of the Mississippi Valley and advanced over the ocean, it is shown that the high and low areas traced from the American coast during 1885 corresponded closely in number, and a careful tracing of the high areas from the ninetyeth meridian shows few instances wherein they deviated from the normal south of east track over the western Atlantic.

On account of the numerous combinations in the relative positions of high and low barometric areas which they present upon leaving the coast, it is not possible with our present knowledge of ocean meteorology to formulate an infallible rule for determining their movements. A set of rules could, however, be deduced from an exhaustive study of individual high and low areas, whereby cyclones of a given intensity and pursuing similar paths could be classified, and their relation to, and dependence upon, anti-cyclones determined. By this means the position, strength, and progressive velocity of cyclones, as well as their proximity or relation to anti-cyclones would permit of their classification with storms which had presented similar characteristics, and whose course subsequent to leaving the coast had been determined. This classification would seem the more necessary in the case of cyclonic areas on account of the more frequent irregularities noted in their movements, which are apparently occasioned in a great majority of instances by the presence or movements of anti-cyclonic areas. A general rule, based upon the movements of anti-cyclonic areas during 1885, may be given, which would doubtless be applicable to a large proportion of the storm-areas which advance over the continent and the ocean. The average time occupied by the fifty-two anti-cyclones traced in advancing from the ninetyeth meridian to the coast was about one and one-half days, this rate of progression being considerably greater than the average velocity of cyclonic areas over that region.

Lines representing the mean paths of the anti-cyclones would converge over the ocean to a point in about N. 35°, W. 35°. Assuming that, by their greater density or weight, and on account of the known regularity of their movements, anti-cyclones largely control the movements of cyclonic areas, it would appear that the probable course and rate of progression of a cyclonic area could be fairly well determined upon its passage from the continent by considering its position relative to well-defined high barometer areas which precede or follow it. Upon advancing to the vicinity of the sixtieth meridian high barometer areas, as a rule, lose their individuality and become a part of the great anti-cyclonic system which commonly occupies mid-ocean south of the fortieth parallel, visibly extending westward to the vicinity of the American coast with the absorption of areas of high barometer, and, subsequent to the union, gradually contracting its western limit. It therefore appears that in the case of cyclones which closely follow the passage of high barometer areas from the coast, it is reasonable to anticipate an abnormal northerly course, and that the greater the period which exists between the advance of the areas from the coast line the greater would be the likelihood of the low pressure area pursuing a normal path over the ocean. This supposition is the more warranted when the fact is taken into consideration that in the normal movement of cyclonic and anti-cyclonic areas, the latter more frequently closely follow and accelerate the forward motion of the former upon passing from the coast, and materially contribute to the greater rapidity of their advance over the ocean.

As regards the changes in position of the anti-cyclonic area over mid-ocean and the occasional shifting to the westward of high barometer areas from over northern Europe, whereby the barometric pressure over the ocean in high latitudes is greatly increased, it would not be possible in the absence of telegraphic reports from east of the thirtieth meridian to determine the barometric conditions

which would exist over the eastern portion of the ocean in advance of a cyclonic depression leaving the American coast. A knowledge of the normal movements of anti-cyclonic areas over the continent and the western portion of the ocean, which is so clearly shown by tracings made of their paths during 1885, and a fair understanding of the relations which exist between high and low barometer areas attending their passage from the coast, would suffice to determine with a considerable degree of accuracy the probable influence of a cyclone's action along a greater part of the trans-Atlantic ship routes. For a more comprehensive knowledge of the more complicated relations which exist between high and low barometer areas attending the abnormal movement of cyclones, it will be necessary to classify for study the anti-cyclonic and cyclonic areas which advance eastward from the American continent, and, following such a classification, it would be possible to recognize the normal and abnormal features peculiar to the storms of the north Atlantic Ocean prior to their departure from the coast, and to determine their probable path.

The paths of the depressions that have appeared over the north Atlantic Ocean and in the vicinity of the West India Islands during the month of October, 1887, are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; reports received through the co-operation of the Hydrographic Office, U. S. Navy, and the "New York Herald Weather Service;" and from other miscellaneous data received at this office up to November 21, 1887.

Sixteen depressions are traced, of which, eight were of tropical or subtropical origin; four advanced eastward over Newfoundland, one of which traversed the ocean from coast to coast; three moved northeastward from the middle Atlantic coast of the United States; one is first charted over the ocean northeast of Newfoundland, and one is located on the last day of the month to the westward of the British Isles.

In the vicinity of the American coast south of the fortieth parallel, the month was characterized by a succession of storms of moderate energy, which advanced northeast towards Newfoundland; while to the northward of the forty-fifth parallel, each decade embraced storms of pronounced strength. To the northward and northeastward of the Windward Islands, and over the west portion of the Caribbean Sea, and in the Gulf of Mexico, there is an unusual prevalence of charted cyclonic depressions, which fact may, perhaps, be attributed to an increase in the number of reports received from those regions, whereby the location and tracks of storms could be the better determined. Over mid-ocean, along the trans-Atlantic tracks, storms were less frequent than during corresponding months of previous years and the depressions traced possessed but normal energy. In the vicinity of the Azores unsettled, and stormy weather, with low and fluctuating barometric pressure, prevailed during a greater portion of the first and second decades of the month. In European waters the weather conditions continued settled, and high barometric pressure prevailed, except at the close of the first, and beginning of the second, decades, and subsequent to the 26th, when the approach and passage of barometric depressions occasioned disturbances, the severity of which were more marked during the last five days of the month.

In October, 1886, fourteen depressions were traced, of which one traversed the ocean. The storms developed greatest intensity off the west coast of Europe, between the forty-fifth and sixtieth parallels, the second decade being especially marked by storms of exceptional violence in that region; over the western portion of the ocean and along the American coast, no storms of pronounced strength appeared after the second day of the month. The tropical cyclone which entered the Gulf of Mexico at the close of the first decade was very severe and destructive in its character.

In October, 1887, the severest weather was experienced in the vicinity of the British Isles during the last five days of the month; over mid-ocean, in high latitudes, there was a marked deficiency in the aggregate number of depressions which appeared, when compared with those traced for corresponding months of previous years; while in middle and southern latitudes the number of storms charted exceed the normal for the month, although reports do not indicate a degree of energy on

the part of the West India cyclones commensurate with that which commonly characterizes the storms of that region.

The following are descriptions of the depressions traced:

1.—The development or presence of a cyclonic area was indicated to the northeastward of Newfoundland on the 1st, and vessel reports of the 2d admitted of locating its centre in about N. 51°, W. 45°. On this date high barometric pressure over the ocean north of the fiftieth parallel and east of the thirtieth meridian apparently retarded the eastward advance of the depression. On the morning of the 4th the area of high barometer had moved to the eastward of the twentieth meridian, and in the interval the storm-centre recurved to the northwestward. During the 4th and 5th the depression moved slowly south of east along the southwest margin of the high pressure area, and on the 6th again recurved to the northward. The continued presence of the area of relatively high barometer to the northeastward, however, apparently checked the storm's inclination to assume a normal advance movement, and forced it southward to the vicinity of the Azores by the 8th, whence it moved north of east, passing over the Bay of Biscay during the 9th, on which date the pressure was high north of the fiftieth parallel between W. 20° and 30°. By the 10th the depression had advanced over the continent of Europe beyond the region of observation. This depression displayed considerable energy during the 1st, 2d, and 3d, after which little strength was shown. The following reports refer to disturbances which attended its passage previous to the 4th:

Captain Jüngst, of the s. s. "Ems," reports a whole gale on the 2d and 3d; wind veered from s. to n.; lowest barometer, 29.34 (745.2), at 4 p. m. of the 2d, in N. 48° 44', W. 36° 36'. The s. s. "Milanese" encountered a strong gale on the 1st and 2d; wind veered from sse. to ssw.; lowest barometer, 29.53 (750.0), at noon of the 2d, in N. 46° 58', W. 29° 46'. Capt. R. T. Jones, of the s. s. "Galileo," reports a fresh gale on the 3d; wind veered from sse. to nw.; lowest barometer, 29.53 (750.0), at 4 a. m., in N. 47° 58', W. 39° 42'.

2.—This storm apparently originated off the coast of the United States south of the fortieth parallel during the 4th; on the 5th the depression was central in about N. 38°, W. 69°, whence it moved northeast to the southeast extremity of Newfoundland by the 7th; by the 8th the storm-centre had recurved northwestward and united with a cyclonic area which had advanced eastward over the Gulf of Saint Lawrence. This depression was unattended by noteworthy features.

3.—This depression is traced from the Caribbean Sea westward along the twentieth parallel over Yucatan and the southern portion of the Gulf of Mexico during the 6th, 7th, and 8th, its path being determined, approximately, by a limited number of vessel reports. While the cyclonic nature of this storm is well defined by charted reports, its course was too far to the southward to accurately determine its strength.

4.—The presence of this depression over the Caribbean Sea was shown by reports of the 8th; by the 9th the storm-centre had apparently moved westward to about N. 19°, W. 71°, and on the morning of the 10th it had moved northwest over the western extremity of Cuba, whence it passed slowly westward over the Gulf of Mexico. The path of this storm subsequent to the 11th cannot be determined, owing to an absence of reports from the region east of the position it occupied on that date. The following reports show the general character of the disturbances which attended its passage:

"Havana, 10th, barometer 29.89 (759.2); wind se., eleven miles; cloudy weather; $\frac{1}{4}$ cirro-stratus clouds moving from the sw.; storm-centre west of station." Captain McKay, of the s. s. "Alvena," reports: "8th between Cape Maysi, Cuba, and Castle Island, at 4.57 a. m., Greenwich mean time; at 8.12 a. m., barometer 29.63 (752.6), and falling rapidly; 9.27 a. m., barometer lowest, 29.36 (745.7), after which it commenced to rise. The weather during this time was heavy and threatening, with wild-looking clouds from n. to s. and around to w.; at the last-mentioned hour the clouds parted in east to north and the greater portion remained in the south, but no rain fell.

9th, between N. 25° 10', W. 74° 8' and N. 28° 00', W. 74° 15'; at 4.50 a. m., Greenwich time, a fresh gale commenced, with heavy rain and a rough sea from e.; gale continued till 7 p. m., when it moderated; lowest barometer, 29.59 (751.6), 9 a. m."

5.—This depression passed eastward over northern Newfoundland and on the morning of the 9th was central in about N. 50°, W. 54°. During this and the following seven days the storm moved slowly east-southeast, passing over the Azores on the 14th, and disappearing over the ocean to the eastward of that group after the 16th. The abnormal direction of movement assumed by this storm was apparently due to the prevalence over mid-ocean, north of the fiftieth parallel, of an area of high barometric pressure, along the southeast and southern margins of which the depression slowly shaped its path. The character of this storm is shown by the following reports:

Capt. G. Moody, of the s. s. "State of Georgia," reports a fresh gale on the 9th; wind from sw. to nw.; lowest barometer, 29.39 (746.5), at 8 a. m., in N. 44° 46', W. 57° 27'. Captain Trinick, of the s. s. "Milanese," reports a fresh nw. gale on the 9th; lowest barometer, 29.43 (747.5), at noon, in N. 43° 06', W. 57° 46'. Capt. J. Jameson, of the s. s. "India," reports a strong gale from the 8th to the 11th; wind veered from nnw. to nue.; lowest barometer, 29.31 (744.5), at 11.40 p. m. of the 10th, in N. 45° 40', W. 54° 35'.

Third Officer J. H. Mills, of the s. s. "Aurania," Capt. W. H. P. Hains, commanding, reports a whole gale on the 11th and 12th; wind veered from se. to sw.; lowest barometer, 29.19 (741.4), at noon of the 12th, in N. 48° 12', W. 38° 40'. Capt. W. J. Boggs, of the s. s. "Indiana," reports a fresh gale on the 11th and 12th; wind veered from ssw. to nw.; lowest barometer, 29.27 (743.4), at 2 p. m. of the 11th, in N. 45° 32', W. 46° 00'. Captain Milburn, of the s. s. "Ocean Prince," reports a storm on the 11th and 12th; wind backed from se. to e., ne., and nnw., blowing hardest from nnw.; lowest barometer, 28.92 (734.6), at 7.30 p. m., Greenwich time, in N. 38° 07', W. 41° 55'.

6.—The presence of this depression northeast of the Windward Islands was shown on the morning of the 9th; by the 11th the storm had moved northeast to N. 30°, W. 40°, from which position it passed northward and united with depression number 5, which had advanced southeast from Newfoundland.

The following extracts from ships' logs have been furnished by Rev. Benito Vines, S. J., director, Belen Meteorological Observatory, Havana, Cuba:

"The Spanish s. s. 'Navarro,' October 10th, at night, fine weather, steady west wind, light clouds, moving swiftly from s., growing heavier, and wind changing to the third quadrant; 11th, in N. 34° 0', W. 40° 20', at noon; during the early morning the barometer fell rapidly, with wind se. and ese., and violent gusts and high sea from sw., and heavy rain. At 7 a. m. the wind was furious from ene., with heavy rain and enormous seas from the second and third quadrants; 8.30 a. m., wind ne., blowing with terrible fury; sea confused from third, second, and first quadrants, being more pronounced from sw.; 9.30 a. m., wind nne., with terrific squalls; intervals of calm, and barometer oscillating from 28 to 29 inches; 11.30 a. m., wind nw.; barometer rising rapidly. The s. s. 'Ardanach,' October 11th, at noon, in N. 37° 20', W. 38° 23', strong sw. gale and a very heavy sea; barometer 29.49 (749.0) and very unsteady; 4 p. m., wind increasing to about force 10; low stratus and nimbus clouds, moving very rapidly from wsw.; barometer falling; 6 p. m., wind suddenly shifted to w., and blew with hurricane force, causing a fearful sea; continued blowing at about force 12 for four hours, and at 10 p. m. commenced to moderate. During the storm the lowest barometer reading was 29.20 (741.7) and not so unsteady as at noon; the clouds were very low stratus and were travelling very rapidly from the w. The storm seemed to occupy a small area, as previous observations showed fine weather, and the same prevailed shortly after the storm's passage."

7.—This storm is first charted over the Caribbean Sea south of Jamaica under date of the 11th, whence it moved slowly west-northwest to the Texas coast by the 18th, after which it

recurred northeastward. The following reports indicate the character of the disturbances which attended its passage:

"The corvette 'Nalon,' from Belize to Cienfuegos; 10th, in N. 19° 50', W. 75° 20', heavy sea from ese.; in southeast quadrant heavy clouds, which caused violent gusts of wind and rain; wind oscillated from ese. to se. and barometer fell slowly. 11th, in a. m., wind hard from ese., heavy clouds and violent gusts of rain and wind; in p. m. barometer fell considerably, to 29.33 (705.0) at 6 p. m., weather dark, and rain continuous; 8 p. m., terrible rolling sea from ese. to ssw.; during the night continuous rain and violent gusts; barometer fell to 29.21 (742.0). 12th, in a. m., rain continued, with hurricane from se. to s., the sea a boiling mass, and so it continued to the end of the day's run, in N. 20° 45', W. 77° 0', with barometer steady at 29.21 (742.0), in afternoon much rain and wind, sea more moderate; 6 p. m., weather cleared somewhat, and barometer rose slightly; during night violent gusts from s. and ssw. 12th, noon, in N. 20° 50', W. 76° 30', barometer rising slowly to 29.29 (744.0), hard gusts. 13th, hard sw. gusts at long intervals; sea from ese., and diminishing; barometer rising."

Havana, 12th, 9 a. m., barometer 29.74 (755.4), e., light rain, 10 miles, storm-centre sse. of station; 3 p. m., barometer 29.64 (752.8), e., heavy rain, 20 miles, storm-centre south of station. Havana, 13th, barometer 29.69 (754.1), e., light rain, 25 miles. Cienfuegos, 12th, 3 p. m., barometer 29.70 (754.4), se., heavy rain, violent gusts. Havana, 14th, 6 a. m., barometer 29.70 (754.4), se., cloudy, 19 miles, storm-centre sw. of station, moving west. Trinidad, Santa Cruz, violent gusts from se., light rain; seaswell sse. Capt. James Bolger, of the s. s. "Neuces," reports a strong gale from the 13th to the 15th; wind veered from nne. to ene.; lowest barometer, 29.73 (755.1), at 12 noon of the 14th, in N. 24° 50', W. 85° 3'. After the gale the wind continued to blow from ese., accompanied by heavy rain squalls to Key West. Capt. P. H. Hanlon, of the s. s. "Mascotte," reports a whole gale on the 14th and 15th; wind veered from ne. to se.; lowest barometer, 29.68 (753.9), at 1 a. m. of the 15th, in N. 25° 30', W. 82° 20'. Captain Jørgensen, of the bark "Adele Sabina," reports a storm on the 19th and 20th; wind veered from ese. to wnw.; lowest barometer, 29.35 (745.5), at 1 p. m. of the 19th, in N. 30° 08', W. 87° 10'. Capt. John Stewart, of the bark "Gettysburg," reports a storm on the 19th; wind veered from se. to w.; lowest barometer, 29.38 (746.2), at 11 a. m., in N. 29° 55', W. 87° 10'.

8.—This depression first appeared east of Bermuda on the 12th, whence it had apparently advanced from eastward of the Windward Islands; by the 13th the storm-centre had moved rapidly north-northeast and united with depression number 9 on the northeast edge of the Banks of Newfoundland, without evidence of marked energy.

9.—This storm passed southeast from the northern extremity of Newfoundland and united with number 9, as above stated; subsequent to the morning of the 13th the depression advanced rapidly east-southeast and united with number 5 in the vicinity of the Azores, without a special display of strength.

10.—This depression was central on the 14th in about N. 35°, W. 69°, whence it had advanced from the southwestward; by the 15th the storm-centre had moved rapidly northeast to the east coast of Newfoundland, and thence passed to N. 52°, W. 39°, after which it disappeared in the direction of Iceland beyond the region of observation. This storm possessed moderate strength, and was accompanied by fresh to strong gales during the 15th and 16th.

11.—This storm apparently originated in the tropics, east of the fiftieth meridian, and by the 16th it was central in about N. 17°, W. 52°, whence it moved slowly northwest to the twenty-fifth parallel by the 18th. During the next twenty-four hours the centre of depression recurred northeastward to the thirtieth parallel, after which it passed northward and probably united with depression number 12. No special reports have been received relative to this storm, and a scarcity of simultaneous observations from the region through which it passed renders it impossible to determine its strength.

12.—This depression appeared off the coast of the United States, in the vicinity of the thirty-fifth parallel, on the morning of the 19th, whence it passed northeast to the fortieth parallel in about W. 65°, and thence advanced eastward to the sixtieth meridian by the morning of the 20th. During this and the following date the depression moved slowly southeast and disappeared after the 21st. The abnormal direction of movement assumed during the last two days of its course was apparently occasioned by an area of relatively high pressure which occupied the ocean to the northeastward of its position. The storm displayed small energy, and, aside from its abnormal course, was unattended by noteworthy features.

13.—The presence of this depression over the ocean between N. 20° and 25° and W. 45° and 50° was shown by vessel reports of the 22d and 23d, which were not, however, sufficiently numerous in that region to determine its strength or to admit of charting its track previous or subsequent to those dates.

14.—This was the most important depression which appeared during the month, and in its passage from Newfoundland to the British Isles, from the 23d to the 29th, inclusive, augmented energy day by day and occasioned storms of hurricane force over, and to the westward of, the British Isles during the last five days of the month. The depression pursued an almost normal track to the northward of the trans-Atlantic steamer routes, its advance being checked on the 25th by an area of high barometer to the eastward. The giving way to the south-eastward of this area of high pressure was followed during the 26th by an advance on the part of the cyclonic area, which moved slowly eastward to the north of Ireland by the 29th, where it apparently remained almost stationary until the 30th, during which date it probably passed into the North Sea, where its presence was indicated by reports of the 31st.

The following special reports show the character of the disturbances encountered in the southern quadrants of this cyclone during its passage over the Atlantic, previous to which heavy gales were experienced off the coast of the United States, attending the passage of land low area number vi, of which it was a continuation:

Mr. J. Higgins, observer at Saint John's, Newfoundland, reports that on the night of the 24th the wind veered suddenly from northwest to south, and increased to a gale, with heavy rain showers, which continued till 5 a. m. of the 25th. Capt. M. de Jouselin, of the s. s. "La Bretagne," reports a fresh gale on the 26th and 27th; wind veered from wsw. to wnw.; lowest barometer, 29.83 (732.3), at 8 a. m. of the 26th, in N. 49° 20', W. 40° 10'. Capt. H. McKay, of the s. s. "Servia," reports a whole gale on the 26th and 27th; wind veered from wsw. to nw.; lowest barometer, 29.76 (755.9), at 6 a. m. of the 26th, in N. 49° 54', W. 34° 48'. Captain Heeley, of the s. s. "England," reports a strong gale from the 26th to the 28th; wind veered from sw. to nw.; lowest barometer, 29.82 (757.4), at 4 a. m. of the 26th, in N. 49° 43', W. 39° 09'. Capt. Rud Weyer, of the s. s. "Pennland," reports a whole gale from the 25th to 29th; wind veered from se. to nw.; lowest barometer, 29.82 (757.4), at 6 p. m. of the 26th, in N. 50° 00', W. 29° 00'.

Second Officer F. Potts, of the s. s. "British Crown," Capt. A. Smith, commanding, reports a strong s. to wnw. gale on the 25th and 26th; lowest barometer, 29.80 (756.9), at 8 a. m. of the 26th, in N. 50° 38', W. 19° 10'. The s. s. "British Crown" encountered a strong west gale from the 27th to the 29th; lowest barometer, 29.77 (756.1), at midnight of the 28th, in N. 50° 05', W. 32° 50'. Capt. H. C. v. d. Zee, of the s. s. "Edam," reports a whole gale from the 27th to the 29th; wind veered from w. to nw.; lowest barometer, 29.75 (755.6), at 11 p. m. of the 28th, in N. 49° 42', W. 30° 52'. Captain Jeffrey, of the s. s. "Greece," reports a whole gale on the 29th and 30th; wind veered from se. to sw.; lowest barometer, 28.76 (730.5), at 0.45 a. m. of the 30th, in N. 49° 47', W. 4° 49'. Captain Franck, of the s. s. "Australia," reports a whole gale on the 29th and 30th; wind veered from s. to nw.; lowest barometer, 28.75 (730.2), at 11 p. m. of the 29th, when off Portland.

15.—This depression was central on the 30th in N. 31°, W. 74°,

whence it had apparently advanced from the southward; by the 31st it had moved east of north to the thirty-fourth parallel, accompanied by strong to whole gales. The following special reports refer to this storm: Captain Evans, of the s. s. "Claribel," reports a whole gale with squalls of hurricane force from October 30th to November 1st; wind veered from nne. to se. and backed again to nne.; lowest barometer, 29.35 (745.5), at 4 p. m. of the 31st, in N. 37° 00', W. 74° 00'. Captain Schive, of the brig "Lilian," reports: "30th, blowing heavy from ne. and ene., with heavy rain and lightning; 31st, wind lulled and hauled to se. and s., blowing hardest from ssw.; lowest barometer, 29.44 (747.8), from sundown to midnight of the 31st, in N. 35° 30', W. 74° 30'. Capt. A. Leenhard, of the bkt. "Jose E. More," reports a whole gale from October 30th to November 2d; wind veered from ne. to sw. and nw.; lowest barometer, 29.39 (746.5), at 4 p. m. of the 31st, in N. 35° 26', W. 75° 10'. Capt. J. H. Bennett, of the s. s. "Edith Godalen," reports a whole gale on the 30th and 31st; wind veered from ne. to e. and to s. by w.; lowest barometer, 29.32 (744.7), at noon of the 31st, in N. 35° 54', W. 73° 10'.

16.—This depression, which appeared suddenly on the 31st, in N. 56°, W. 21°, with central pressure ranging to about 28.60 (726.4), is thought to have been a subsidiary development to depression number 14, although there is a reasonable likelihood that the last-named storm may have made a recurve westward from its position to the northward of Ireland on the 30th. In an absence of reports from western Europe and from the region north of the fifty-fifth parallel it is not possible at present to determine the movements of this storm subsequent to the 30th. It is hoped, however, that reports received before the next issue of this publication will permit of accurately defining the relations which existed between these depressions.

OCEAN ICE.

On chart i are also shown the positions in which icebergs were reported during October, 1887. These positions are determined from reports furnished by shipmasters, and from data collected by the Hydrographic Office.

Ice was reported on three dates only, viz., on the 17th one very large berg was observed in N. 42° 58', W. 50° 02', from the s. s. "Bassano;" on the 29th two large bergs and several small pieces of ice were passed in N. 52° 05', W. 54° 00', by the s. s. "Grecian," and on the 31st the captain of the s. s. "Toronto" observed two large bergs, one in N. 51° 50', W. 54° 23', and the other in N. 52° 06', W. 54° 08'.

In October, 1886, the southernmost ice reported was over one degree farther south and in about the same longitude, while the easternmost position in which ice was observed was about four degrees farther east than in the corresponding month of 1887; the aggregate quantity greatly exceeded that reported for the present month.

As compared with ice reported for the four preceding years a marked deficiency in quantity is shown for October, 1887. The southernmost position in which ice was observed is about three degrees south of the normal southern limit for the month, while the easternmost ice reported was about two degrees west of the average eastern limit.

The following table shows the southern and eastern limits of the region within which ice was reported for October during the last five years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
October, 1883.....	46 56	46 22	October, 1883.....	46 56	46 22
October, 1884.....	46 56	46 22	October, 1884.....	46 56	50 55
October, 1885.....	48 21	47 12	October, 1885.....	48 21	47 12
October, 1886.....	41 34	49 43	October, 1886.....	46 03	46 37
October, 1887.....	42 58	50 02	October, 1887.....	42 58	50 02

•Near Cape Race.

FOG.

The following are the limits of fog-areas on the north Atlantic Ocean during October, 1887, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
3	S. S. City of Richmond...	41 23	66 59	.....	42 45	62 09	.....
5	S. S. Richmond Hill.....	45 56	56 30	.....	43 58	61 00	.....
5-6	S. S. LaBourgnie.....	48 00	47 00	.....	47 30	57 18	.....
6	S. S. City of Richmond...	46 48	47 39	.....	47 03	46 38	.....
6	Fog at Saint John's, N. F.						
6-7	S. S. Galileo.....	42 04	47 35	.....	41 44	49 05	.....
7	S. S. Eider.....	46 39	47 00	.....	45 49	49 55	.....
7	Fog at Saint John's, N. F.						
9	S. S. Geiser.....	48 55	48 20	.....	47 58	49 56	.....
9	Fog at Saint John's, N. F.						
10	Fog at Saint John's, N. F.						
11	Fog at Saint John's, N. F.						
11	S. S. India.....	46 16	54 08	.....	46 25	53 25	.....
12	Fog at Saint John's, N. F.						
12	S. S. Circassia.....	47 12	50 50	6 a. m.	47 40	49 30	6 p. m.
12	S. S. India.....	47 11	43 42	.....	47 01	44 28	.....
12	S. S. LaChampagne.....	46 55	44 56	.....	46 48	45 32	.....
12-13	S. S. Vaderland.....	46 45	48 30	.....	48 03	43 48	At inter-vals.
13	Fog at Saint John's, N. F.						
13	Fog at Saint John's, N. F.						
15	S. S. Ems.....	45 45	48 25	.....		
20	Fog at Saint John's, N. F.						
21	S. S. Westernland.....	47 14	43 32	.....	45 50	48 31	.....
21	S. S. Main.....	43 10	57 24	.....	43 30	57 51	.....
21	S. S. Surrey.....	43 18	52 00	.....	43 46	48 30	.....
21	Fog at Saint John's, N. F.						
22	Fog at Saint John's, N. F.						
22	S. S. Westernland.....	44 26	52 46	.....	44 22	53 04	.....
22	S. S. Canada.....	46 50	44 26	.....	45 47	48 46	.....
27	S. S. Alamo.....	36 38	74 50	5-40 p. m.	36 10	75 00	7-30 p. m.
28	S. S. City of Washington.	37 58	74 59	10 a. m.	36 51	74 56	4 p. m.
29	S. S. LaBretagne.....	41 50	66 00	9-30 a. m.	41 40	66 20	10-30 a. m.
29-30	S. S. Servia.....	42 17	62 32	11 p. m.	42 02	63 36	2 a. m.
31	S. S. British Crown.....	48 00	49 00	8 p. m.	47 30	49 45	11 p. m.
30-31	S. S. Cephalonia.....	43 42	51 58	.....	44 32	48 34	.....

On chart i the limits of fog-belts to the westward of the fortieth meridian are shown by dotted shading:

As compared with the chart for September, 1887, the southern limit of fog reported in the vicinity of the Banks of Newfoundland during October is shown to be about one-half degree farther south, while the eastern limit is contracted about five degrees. To the southward of Nova Scotia the southern limit remains about the same; in the immediate vicinity of the coast of the United States no fog was reported north of the thirty-eighth parallel, whereas in the preceding month several fog-belts of limited area appeared between N. 37° and 43°.

As indicated by special reports received, fog was less frequently encountered in the vicinity of the Banks of Newfoundland than in September, or during the summer months, while to the westward of the sixtieth meridian the dates covered by reports correspond with the number for which fog was observed in September.

The following shows the general meteorological conditions which attended the development of a fog over and near the Banks of Newfoundland:

From the 5th to the 7th, inclusive, depression number 2 occasioned south to east winds over the Banks, and reports show that dense fog prevailed during this period. During the 9th, 10th, and 11th, the advance of depression number 5 over Newfoundland, and its subsequent presence over the Banks, was accompanied by winds from the southeast quadrant and fog. On the 12th and 13th depression number 8 moved rapidly northeast from the vicinity of Bermuda, passing over the Banks during the 13th; its approach and passage being attended by fog. The fog of the 15th was evidently due to the influence of depression number 10, which moved northeast over Newfoundland during that date. From the 20th to the 22d, inclusive, south to east winds and fog prevailed with the presence to the westward and southwestward of depressions numbers 12 and 14, the latter being a continuation of an area of low pressure of pronounced energy which advanced northeast along the Atlantic coast. During the 30th and 31st south to east winds and fog were reported over the Banks, these conditions being apparently caused by an area of low pressure

which passed eastward north of the region of observation, the presence of which was indicated not only by the wind-direction, but also by the low barometric pressure recorded over and near Newfoundland on those dates. On the dates not included in the above-named periods no fog was reported.

Over the ocean south of Nova Scotia fog was reported on the 3d, 29th, and 30th. On the 3d north to west winds and baro-

metric pressure below the normal attended the presence over New Brunswick of an area of low pressure. During the 29th and 30th depression number 15 caused easterly winds and falling barometer in that locality.

Fog was reported off the coasts of Virginia and Maryland on the 27th and 28th, during the prevalence of which high barometer, north to east winds, and rain prevailed.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for October, 1887, is exhibited on chart ii by the dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iii the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

The mean temperature is decidedly above the normal in Oregon, California, and the plateau districts, and slightly above the normal in eastern Nova Scotia. The excess over the normal temperature is greatest in northern California, where, at Red Bluff, an unusual departure of 10° occurs. On chart iii the line indicating the region over which the temperature was 4° above the normal encloses nearly all of California and portions of Arizona and Nevada.

In districts east of the Rocky Mountains, except eastern Nova Scotia, the temperature is below the normal, the departures exceeding 2° over nearly all of the region named, while in the Lake region and central valleys they range from 4° to 8°.

The following are some of the most marked departures from the normal precipitation at Signal Service stations where the records cover eight, or more, years:

Above normal.		Below normal.	
Red Bluff, Cal.	10.1	Escanaba, Mich.	8.1
Sacramento, Cal.	6.5	Chicago, Ill.	6.7
Yuma, Ariz.	5.8	Detroit, Mich.	6.5
San Francisco, Cal.	4.9	La Crosse, Wis.	6.7
Winnemucca, Nev.	4.3	Davenport, Iowa.	6.5
Los Angeles, Cal.	3.8	Toledo, Ohio.	5.9
Roseburg, Oregon.	2.7	Saint Paul, Minn.	5.7
San Diego, Cal.	2.5	Dubuque, Iowa.	5.7

RANGES OF TEMPERATURE.

The monthly and the greatest and least daily ranges of temperature at Signal Service stations are given in the tables of miscellaneous meteorological data. The monthly ranges varied from 70° to 100° in the upper Missouri valley and thence westward to Idaho; they were least in southern Florida and on the west Gulf and Pacific coasts.

The following are some of the extremes:

Greatest.		Least.	
Fort Custer, Mont.	100.5	Eureka, Cal.	16.9
Fort Maginnis, Mont.	87.9	Key West, Fla.	19.3
Valentine, Nebr.	84.5	Tatoosh Island, Wash.	19.7
Deadwood, Dak.	81.9	Fort Canby, Wash.	29.9
Poplar River, Mont.	81.7	Brownsville, Tex.	35.2
Saint Vincent, Minn.	81.5	Corpus Christi, Tex.	35.2
Fort Buford, Dak.	80.1	San Diego, Cal.	35.2
Fort Assinaboine, Mont.	79.8	Galveston, Tex.	36.8

The greatest daily range of temperature reported from Signal Service stations was 55° at Bois  City, Idaho; the least, 3°, occurred, at Block Island, R. I., Cape Henry, Va., Vicksburg, Miss., Brownsville, Tex., and Astoria, Oregon.

Table of comparative maximum and minimum temperatures for October.

State or Territory.	Stations.	For 1887.		Since establishment of station.				Length of record.
		Max.	Min.	Max.	Year.	Min.	Year.	
Alabama	Mobile	87.2	34.0	93.4	1884	34.0	1873	17
Do	Montgomery	86.2	32.0	90.1	1884	33.0	1873	16
Arizona	Prescott	85.0	28.8	86.0	1881	18.0	1880	12
Do	Fort Apache	88.0	28.1	86.9	1885	19.0	1880	9
Arkansas	Fort Smith	89.6	32.2	94.6	1884	31.0	1886	6
Do	Little Rock	89.3	33.1	90.0	'81, '83, '84	33.1	1886	9
California	San Francisco	87.0	49.2	84.0	1871	45.0	1881	17
Do	San Diego	85.0	49.8	92.0	1879	44.0	1878	16
Colorado	Denver	85.1	7.8	86.0	1873	1.0	1873	16
Do	Pike's Peak	44.3	0.2	57.3	1886	17.0	1878	14
Connecticut	New Haven	74.7	24.9	86.0	1881	25.1	1886	15
Do	New London	73.3	29.9	82.7	1879	27.2	1883	16
Dakota	Fort Buford	80.4	0.3	95.0	1879	9.0	1881	9
Do	Yankton	80.2	13.3	89.0	1879	9.0	1878	15
Dis. of Columbia	Washington City	85.2	30.9	92.3	1881	26.0	1873	17
Florida	Jacksonville	87.9	40.0	92.0	1883	40.0	1873	17
Do	Key West	86.4	67.1	92.0	1876	65.0	1873	17
Georgia	Atlanta	82.1	30.1	90.8	1884	33.6	1884	10
Do	Savannah	85.0	47.8	92.0	1884	37.0	1873	17
Idaho	Bois� City	87.4	16.4	85.0	1879, 1880	19.0	1878	11
Illinois	Cairo	82.5	27.7	88.0	1872, 1881	24.0	1873	16
Do	Chicago	82.0	14.2	84.0	1879	25.0	1873	16
Indiana	Indianapolis	82.4	22.3	87.0	1884	23.0	1878	15
Indian Ter.	Fort Sill	88.7	30.7	91.0	1878, 1884	44.0	1878	10
Iowa	Dubuque	85.1	14.6	86.0	1879	20.0	1873	14
Do	Des Moines	82.6	13.8	85.8	1884	15.0	1878	10
Kansas	Dodge City	92.4	21.6	90.0	1883	10.0	1878	14
Do	Leavenworth	89.3	23.0	89.0	1871, 1874	19.0	1873	17
Kentucky	Louisville	84.0	25.5	90.0	1884	27.0	1878	16
Louisiana	New Orleans	86.0	41.8	90.0	1884	40.0	1873	17
Do	Shreveport	91.2	37.8	95.0	1883	31.0	1873	15
Maine	Eastport	64.0	26.5	80.0	1879	24.0	1881	14
Do	Portland	69.3	27.9	83.0	1879, 1881	27.6	1886	16
Maryland	Baltimore	85.3	32.2	89.0	1879, 1881	30.0	1873, 1879	16
Massachusetts	Boston	73.1	27.2	90.0	1881	25.0	1879	17
Michigan	Marquette	76.7	12.5	87.0	1879	18.0	1878	14
Do	Grand Haven	76.0	20.2	80.0	1879	23.5	1885	15
Minnesota	Saint Vincent	71.2	10.3	81.6	1886	10.2	1884	8
Do	Saint Paul	72.4	11.5	87	1879	15.0	1878	16
Mississippi	Vicksburg	88.0	33.5	93.7	1886	34.0	1873	16
Missouri	Saint Louis	86.5	24.0	90.0	1879	25.0	1873	17
Montana	Ft. Assinaboine	76.8	30.0	83.0	1884, 1885	16.0	1881	8
Do	Helena	74.2	2.7	76.9	1885	10.0	1881	8
Nebraska	North Platte	85.0	9.1	89.0	1879	11.0	1878	14
Do	Omaha	81.0	15.8	87.0	1879	15.0	1878	15
Nevada	Winnemucca	87.0	17.6	84.0	1879	10.0	1878	9
New Hampshire	Mt. Washington			59.0	1871	3.0	1881	17
New Jersey	Atlantic City	77.0	34.5	83.0	1880	29.0	1879	14
New Mexico	Santa Fe	78.0	31.0	85.0	1878	16.0	1880	13
New York	Buffalo	69.4	24.4	83.0	1879	24.7	1884	15
Do	New York City	78.0	32.0	88.3	1881	31.0	1876	17
North Carolina	Charlotte	83.9	35.5	91.9	1884	30.0	1879	9
Do	Wilmington	85.3	34.8	92.5	1884	32.0	1876	17
Ohio	Cincinnati	81.4	26.1	87.7	1884	27.0	1873	17
Do	Sandusky	85.0	24.0	87.0	1879	30.0	'78, '80, '84	11
Oregon	Portland	75.4	32.9	82.2	1885	31.0	1877	15
Do	Roseburg	82.0	26.5	90.0	1885	22.5	1881	11
Pennsylvania	Pittsburg	80.3	20.0	91.1	1884	28.0	'73, '76, '78	17
Do	Philadelphia	84.2	30.6	87.0	1881	31.0	1873, 1876	17
Rhode Island	Block Island	70.5	36.0	75.4	1881	32.6	1884	8
South Carolina	Charleston	87.7	42.9	93.0	1883	39.0	1873	15
Tennessee	Knoxville	82.0	27.9	94.0	1884	25.0	1876	17
Do	Memphis	88.0	32.6	92.0	1879, 1884	29.0	1878	15
Texas	Brownsville	85.7	50.5	95.0	1877	49.0	1879	11
Do	Fort Elliott	89.3	25.3	88.0	1880	26.0	1880	7
Utah	Salt Lake City	85.2	27.5	83.0	1876	22.0	1878	14
Virginia	Lynchburg	88.2	30.0	91.3	1884	28.0	1879	15
Do	Norfolk	87.0	30.7	89.0	1881, 1884	31.0	1876	17
Washington	Spokane Falls	69.1	12.3	77.0	1886	18.0	1881	7
Do	Olympia	65.7	30.0	73.0	1880	23.0	1881	11
Wisconsin	La Crosse	82.5	6.2	84.0	1884	18.0	1873	15
Do	Milwaukee	74.3	14.8	83.1	1884	22.0	1878	17
Wyoming	Cheyenne	81.6	4.3	80.0	'73, '74, '79	4.0	1878	13

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperatures for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for October, 1887; (4) the departures of the current month from the normal;